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Kennedy/Jenks Consultants

South Tacoma Field
Superfund Site
Tacoma, WA

Blackberry Investigation Report



USEPA SF



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K/J Project No. 916055.13
Draft Report

BLACKBERRY INVESTIGATION REPORT

**SOUTH TACOMA FIELD
SUPERFUND SITE
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY**

DRAFT

Prepared for
SOUTH TACOMA FIELD SITE GROUP

Prepared by
**KENNEDY/JENKS CONSULTANTS
Engineers and Scientists
530 South 336th Street
Federal Way, Washington 98003**

K/J 916055.13

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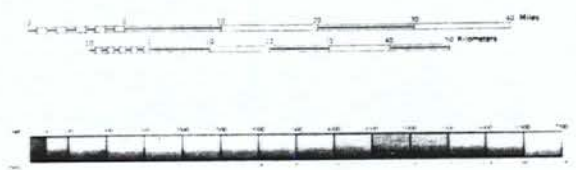
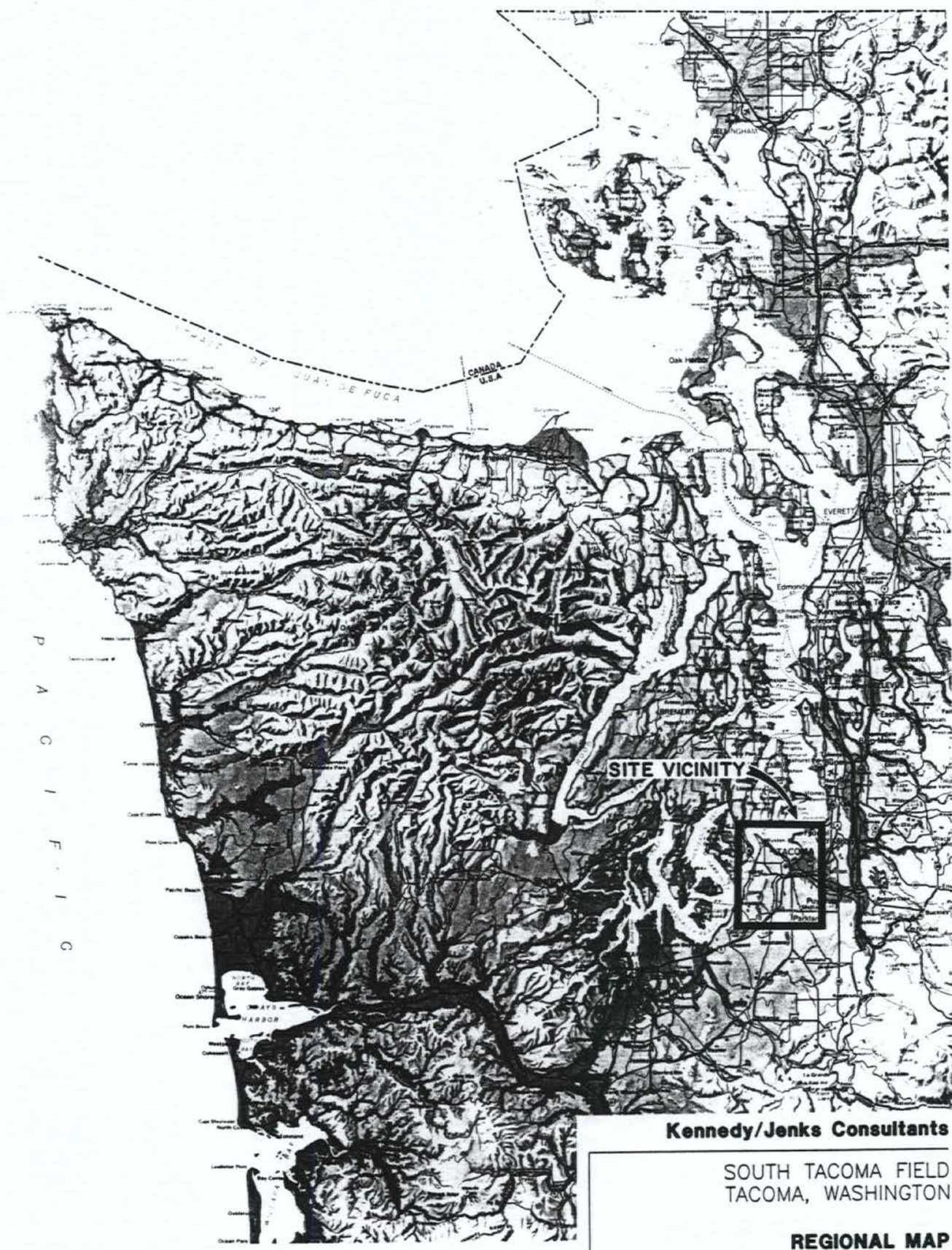
1.0 INTRODUCTION

This report describes findings associated with the Blackberry Investigation conducted as part of the South Tacoma Field (STF) Remedial Investigation. The STF site, located in Tacoma, Washington, is a largely vacant industrial property approximately 300 acres in size. The site is in western Washington State (Figure G-1) in the southwestern section of the City of Tacoma (Figure G-2).

In 1981, the U.S. Environmental Protection Agency (EPA) placed the STF site (as part of the Commencement Bay-South Tacoma Channel site) on the National Priorities List for sites to be investigated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986]. On 12 October 1990, EPA and the potentially responsible parties (PRPs) signed an Administrative Order on Consent (Consent Order). The Consent Order, among other requirements, directs that a remedial investigation be performed to determine the nature and extent of environmental contamination by hazardous substances at the STF site.

The Consent Order cites the Final Work Plan, which establishes the level of effort required by EPA to complete a Remedial Investigation/Feasibility Study (RI/FS) at the STF site. The Final Work Plan was prepared for EPA by ICF Technology, Inc. (ICF 1990b). Kennedy/Jenks Consultants was retained by the PRPs to conduct the RI/FS in accordance with the Final Work Plan, Revision 1, dated September 1990 (ICF 1990b).

The RI comprises investigations of potential contamination associated with several media, including surface soil and subsurface soil, groundwater, surface water/sediment, air, and blackberries. A soil gas survey, geophysical survey, and wetland delineation and endangered plant species survey are also included in the RI. Results of each media investigation will be presented separately in draft and final reports



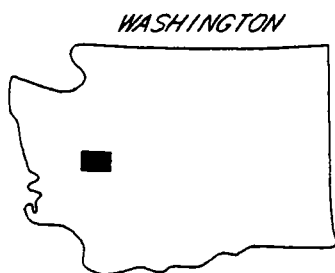
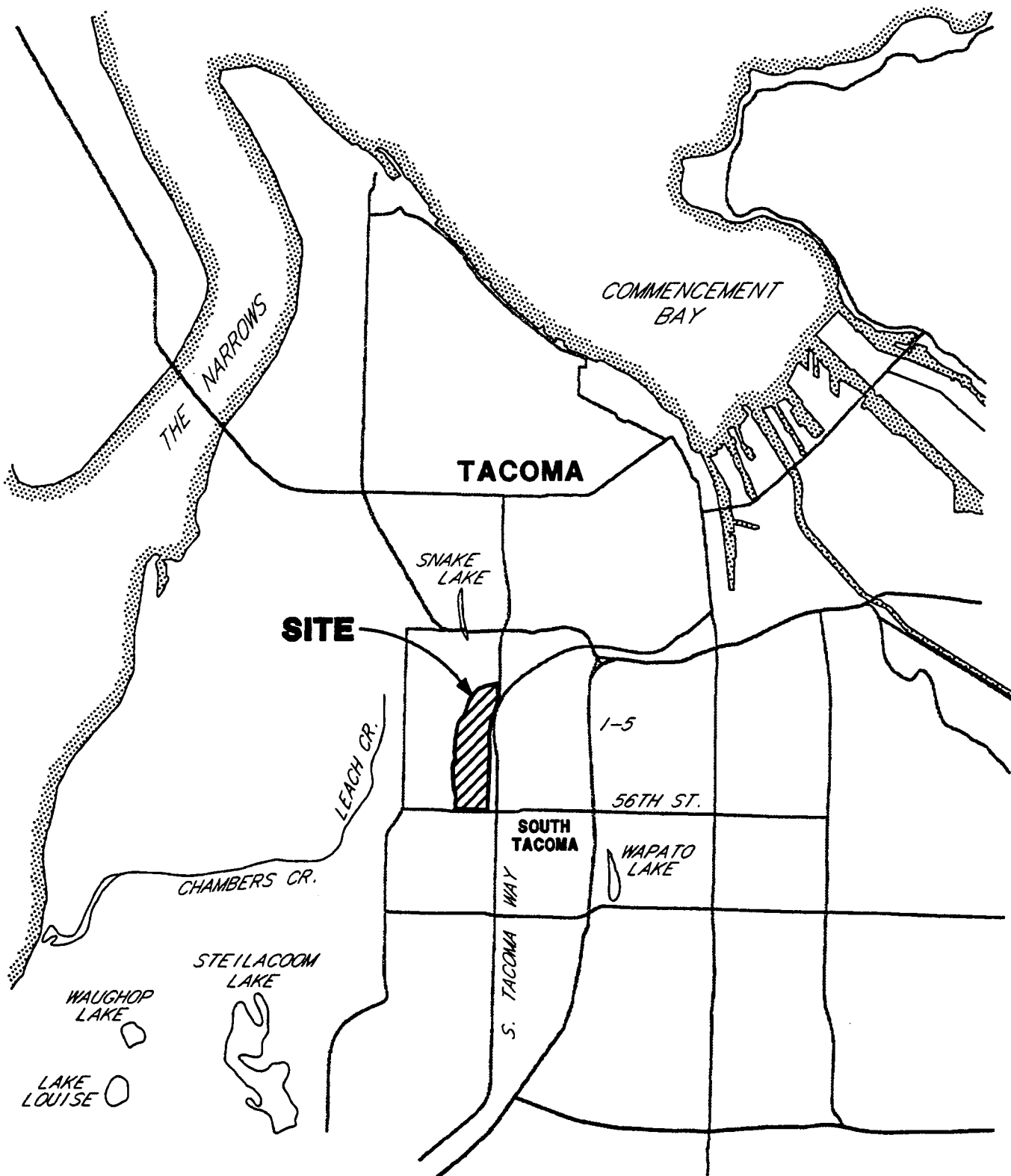
Kennedy/Jenks Consultants

**SOUTH TACOMA FIELD
TACOMA, WASHINGTON**

REGIONAL MAP

916055.02/P1SK092

FIGURE G-1



Kennedy/Jenks Consultants

SOUTH TACOMA FIELD
TACOMA, WA

SITE LOCATION MAP

916055.13/P1SK109

FIGURE G-2

and then synthesized into the RI report. This draft report presents the findings of the STF Blackberry Investigation.

1.1 PURPOSE OF INVESTIGATION

The objective of the Blackberry Investigation is to evaluate the potential for priority pollutant metal contamination on blackberry fruit growing onsite and in the vicinity of the STF site. Analytical results from this investigation will be used to assess potential health risks associated with the ingestion of blackberries from the STF site.

The Blackberry Investigation includes the following specific objectives:

- Identify background concentrations of priority pollutant metals (listed in Table BB-2, Section 4.0) and boron in blackberry samples collected from offsite blackberry patches.
- Identify onsite concentrations of priority pollutant metals and boron in blackberry samples collected from onsite blackberry patches.
- Compare concentrations of priority pollutant metals and boron associated with samples collected onsite vs offsite.
- Compare analytical results for washed vs unwashed samples to evaluate the extent, if any, to which plant uptake (washed samples) and atmospheric deposition (unwashed samples) have resulted in metal accumulation in and on the blackberries.

Blackberry sampling procedures and subsequent laboratory analyses are detailed in the STF Blackberry Investigation Field Sampling and Analysis Plan (FSAP)

Amendment (Kennedy/Jenks Consultants 1991) and the STF Quality Assurance Project Plan (QAPjP) (Kennedy/Jenks/Chilton 1991).

1.2 REPORT ORGANIZATION

This Blackberry Investigation Report is organized as outlined below:

- Section 1.0 presents an introduction, the purpose of the investigation, and site background, including a description of the site and a summary of site history and current land use.
- Section 2.0 summarizes the investigative approach, including a description of the sampling rationale and methods. Sample locations, collection procedures, and analytical parameters are also discussed.
- Section 3.0 summarizes the quality assurance (QA) program for field and laboratory data, and includes a discussion of the data validation process.
- Section 4.0 provides an evaluation of the investigative results of samples collected from offsite (background) and onsite locations.
- Section 5.0 presents conclusions based on the analytical results reported in Section 4.0.
- Section 6.0 includes complete references to documents cited in this report.

Analytical results, the Blackberry Data Validation Report, and explanatory material (e.g., list of laboratory and data validation qualifiers) are presented in Appendix A (Data Appendix).

1.3 SITE BACKGROUND

This section presents a brief site description, site history, and summary of current site use. More detailed information is provided in the Final Work Plan (ICF 1990b) and in the Site Background Summary Report (ICF 1990a).

1.3.1 Description

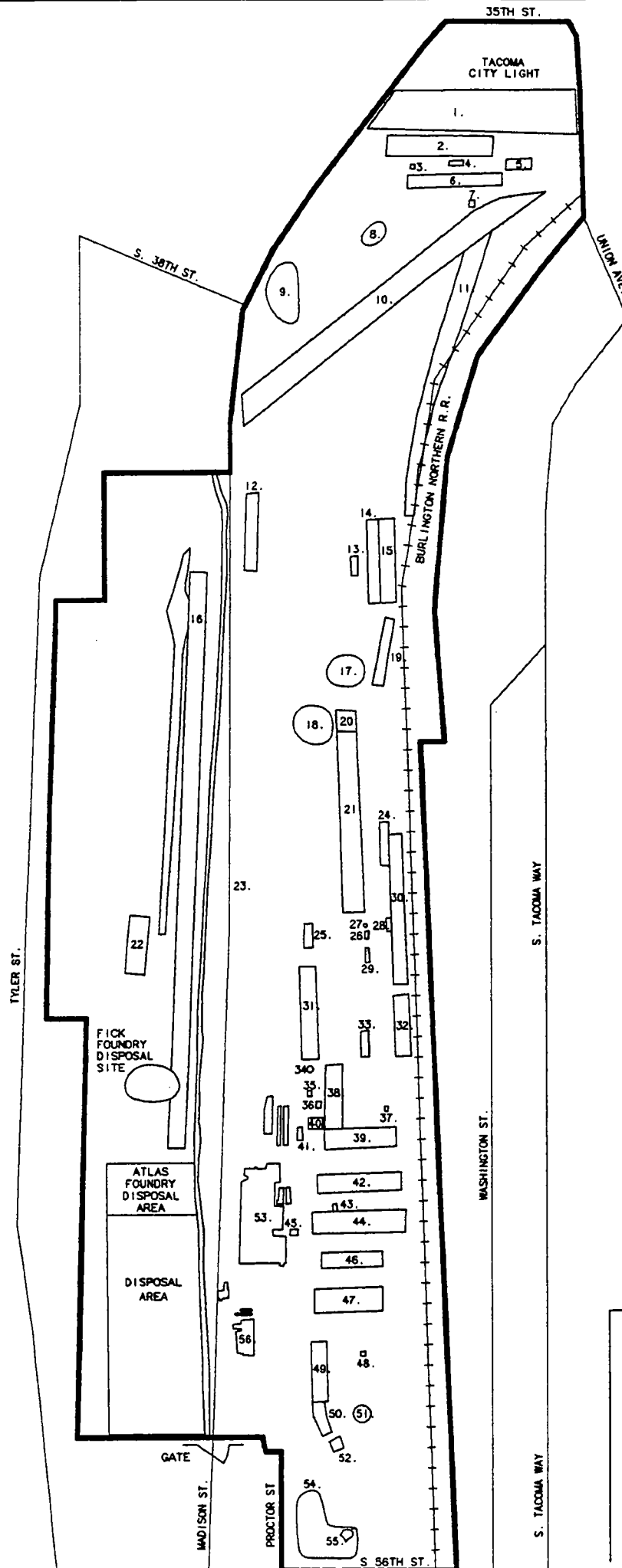
The STF site is located on the floor of a topographic lowland area referred to as the South Tacoma Channel, which is as much as 150 feet lower than the surrounding uplands. The site, once covered with industrial structures, is now mostly open fields of grass with a few commercial facilities. Surface water is sometimes present in the western portion of the site, but no creeks, streams, or rivers currently pass through the site. Numerous blackberry patches are located throughout the site and surrounding marshy areas (Figure BB-1; foldout, inside back cover).

1.3.2 History

This discussion of historical activities at the STF site is based on material contained in the Site Background Summary Report (ICF 1990a). A more complete description of STF site history is available in the ICF reference, along with references to other documents that provide additional historical site use information.

The STF site has been used for a variety of industrial purposes for approximately 100 years. Locations where various activities have taken place at the site are shown in Figure BB-2. Areas where significant historical activities occurred are briefly discussed in the following paragraphs.

The South Tacoma Car Shops area (Figure BB-2, legend numbers 12 through 51) operated as a manufacturing and repair facility from 1892 until 1974. The area

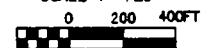


LEGEND

— STF-NPL SITE BOUNDARY

1. TCL YARD AREA
2. GANTRY CRANE AREA
3. FUEL TANK
4. SHED
5. LANTERN SHED
6. STOREHOUSE, BELTHOUSE
7. FUEL CELLAR
8. BURN PIT
9. TRASH DUMP
10. STORAGE YARD
11. RUBBISH TRACK CORRIDOR
12. CONCRETE CASTING PLANT
13. SANDBLAST SHED
14. BLACKSMITH SHOP
15. CONCRETE FLOOR
16. LANDING STRIP
17. TRASH BURNING AREA
18. TRASH PIT (PAINT SHOP)
19. CAR CASTINGS PLATFORM
20. PAINT SHOP
21. CAR SHOP
22. AIRPORT BLDG
23. MADISON STREET
24. OPEN SHED
25. DRY KILN
26. WASTE SOAKING VAT
27. UST (OIL)
28. PAINT SHOP
29. PAINT HOUSE
30. FREIGHT REPAIR SHED
31. FINISHED LUMBER SHED
32. WHEEL SHOP
33. GENERATOR HOUSE
34. UST (OIL)
35. PUMPS
36. DIP TANK
37. DROP PIT
38. WOODWORKING SHOP
39. COACH SHOP
40. BOILER HOUSE
41. OIL TANKS
42. PAINT SHOP
43. BRASS
44. MACHINE SHOP
45. SOLVENT SHED
46. BOILER, TIN TANK, AND COPPER SHOP
47. SOUTH MACHINE SHOP
48. TRASH BURNER
49. BLACKSMITH SHOP
50. IRON & STEEL STORAGE
51. TURNTABLE
52. COKE & COAL
53. FORMER IRON FOUNDRY
54. RAILCAR CLEANOUT AREA
55. BURIED DRUMS (REMOVED)
56. FORMER BRASS FOUNDRY SITE

SCALE 1"=720'



BASE MAP REFERENCE

WALKER & ASSOC. 10-22-86
SURFACE DEBRIS SAMPLING PLAN
FEBRUARY 1987
FOR SITTS & HILL ENGINEERS, INC.
RETEC REMEDIATION TECHNOLOGIES, INC.
SOUTH TACOMA SWAMP

Kennedy/Jenks Consultants

SOUTH TACOMA FIELD
TACOMA, WA

MAJOR HISTORICAL USES OF THE STF SITE

916055.13/P1SK111

FIGURE BB-2

was used for manufacturing, repair, and maintenance of railcars, engines, boilers, and tanks.

The Dismantling Yard (Figure BB-2, legend numbers 2 through 11) was located in the northern portion of the Car Shops area. Cars were cleaned out and discarded materials reportedly were buried in a trash pit or burned in this area.

Foundry facilities (Figure BB-2, legend numbers 53 and 56) operated onsite from approximately 1890 through 1980. An iron foundry produced iron wheels until 1957. A brass foundry produced journal bearings composed primarily of lead, tin, copper, and zinc until 1980.

The South Tacoma Airport (Figure BB-2, legend numbers 16 and 22) operated from 1936 to 1973. Aircraft maintenance and refueling operations were performed at this location during those years. A lake was located beyond the south end of the former runway and, in the late 1940s, was used by seaplanes.

Throughout the history of the site, a variety of filling activities have been reported. Foundry, construction, and domestic wastes reportedly were dumped as fill material in the Former Swamp/Lakebed area (ICF 1990a). In the 1930s and 1940s, portions of the site reportedly were used as unauthorized household and commercial waste dumping areas.

Tacoma City Light (TCL) operations are located at the north end of the site (Figure BB-2, legend number 1). Repair, maintenance, and distribution of electric and water service equipment have occurred at the TCL site since 1953.

1.3.3 Current Site Use

Much of the STF site is currently undeveloped and is covered with field grass, blackberries, shrubs, and a few trees. Concrete rubble, old foundations, and trash

are apparent in some areas. A portion of the STF site is used for light industrial and commercial operations. Some businesses have operated from facilities previously used in association with the foundries and the railyards, while other manufacturers have constructed new facilities. Information in this section has been prepared using the Site Background Summary Report (ICF 1990a).

Tacoma Industrial Properties (TIP) Management Inc. owns property in the central portion of the STF site and uses the area for a variety of industrial purposes. Three businesses operate on TIP property: KML Corporation, Savage Industries, and Northwest Welding and Fabrication (NWF). KML Corporation has operated at the old iron foundry since 1986. KML laminates films onto particle board for the construction of cabinets and interior partitions. Savage Industries manufactures wood picture frames in an old Burlington Northern wood patterns and vaults building. NWF operates on the southeast portion of TIP. NWF activities include repair of boats, motors, and boat trailers, as well as steel fabrication and repair.

Facilities recently constructed on STF site property include the General Plastics and Pioneer Builders Supply buildings. General Plastics manufactures high-density rigid and flexible polyurethane foams and high-density rigid polyisocyanurate foams. Pioneer Builders Supply purchased land in the southeast portion of the STF site for a warehouse and office building that were constructed in 1988. Pioneer Builders Supply operates a distribution center for asphalt and cedar roofing materials.

2.0 INVESTIGATIVE METHODS

This section presents a description of the background and onsite blackberry sampling investigation, including a discussion of the sampling rationale, sampling locations, sample collection methods, and analytical parameters.

2.1 BACKGROUND BLACKBERRY SAMPLING

An understanding of the concentrations of chemicals of concern in blackberries at offsite locations is required to evaluate background concentrations of these analytes in blackberries growing in the vicinity of the site. Offsite samples were collected and analyzed to assess the significance of chemical concentrations by comparing these background concentrations to those detected in blackberries growing on the STF site.

Chemical constituents in blackberries may be present due to natural and anthropogenic sources (e.g., atmospheric deposition from industrial and vehicular emissions). An attempt was made to collect background blackberry samples representative of both area (anthropogenic) and natural background conditions. Area background blackberry samples were collected to assess the concentrations of chemicals of concern detected in the vicinity of the site that are not related to releases from the site, but that may still contain chemical concentrations of anthropogenic origin. Natural background blackberry samples were collected to assess the concentrations of chemicals of concern consistently detected in blackberries in the environment that are not attributed to local human activity. These definitions of area background and natural background samples are based on the Model Toxics Control Act Cleanup Regulation (1991).

Samples were collected from offsite (background) areas within the South Tacoma Channel, the same geomorphic feature in which the STF site is situated. Samples

collected offsite, but within the South Tacoma Channel, were intended to provide representative natural and area background concentrations in blackberries growing under similar soil conditions as those growing on the STF site.

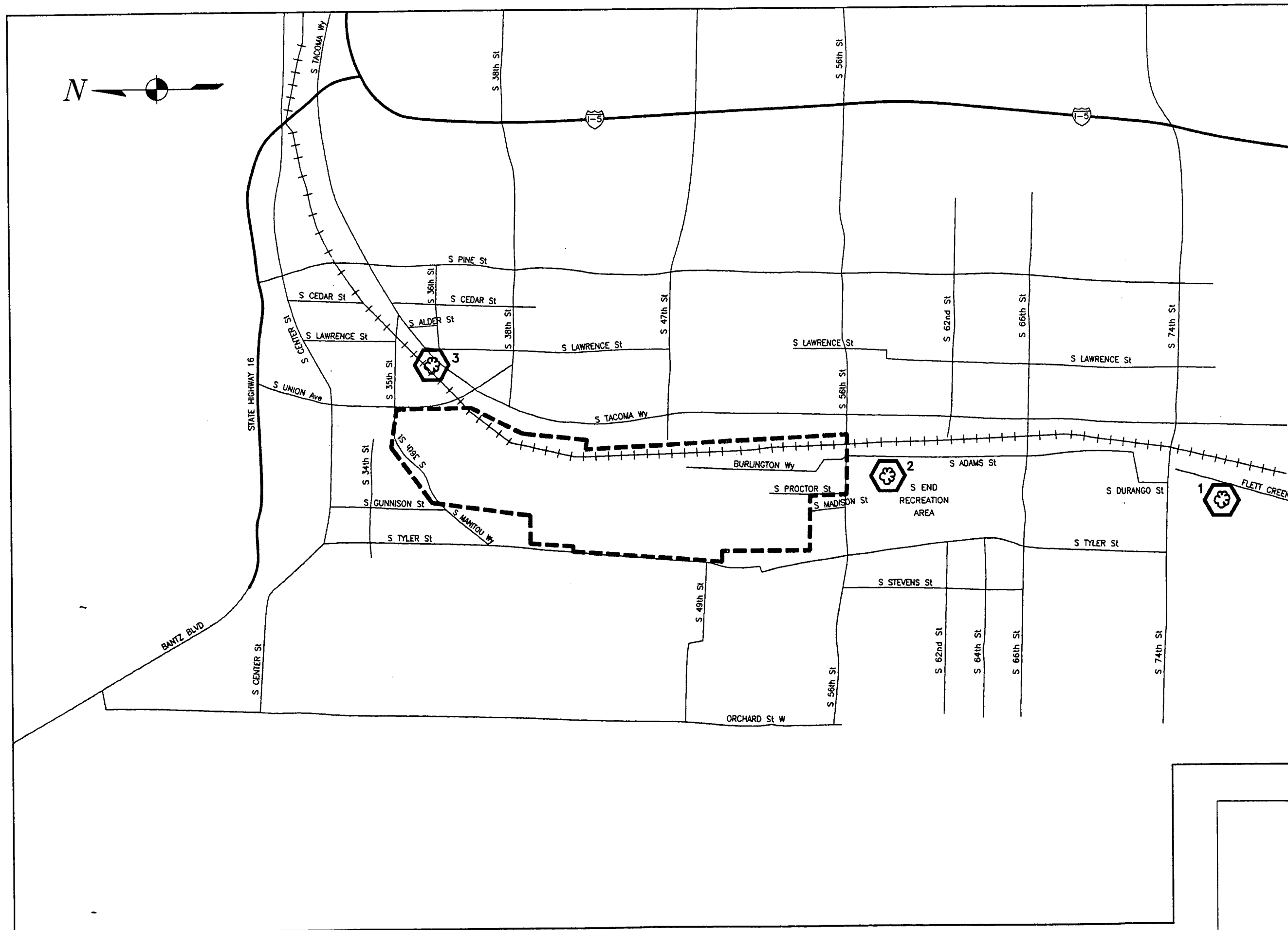
Six background blackberry samples were collected from three offsite locations in the South Tacoma Channel (i.e., two composite samples at each location). The following background sampling locations are within approximately 1 mile of the STF site and are shown in Figure BB-3:

- Flett Creek drainage area approximately 1/4 mile south of South 74th Street
- 58th Street and South Adams Street
- Between South Tacoma Way and the Burlington Northern Railroad tracks near Warner Street.


The Flett Creek drainage area is located in an undeveloped, non-industrial area of the South Tacoma Channel. Analytical results for samples collected from this background location will be used to evaluate natural background concentrations of chemicals of concern in blackberries.

The two other background sampling locations are located in industrial areas with high volumes of vehicular traffic similar to conditions near the STF site. One of these locations, 58th Street and South Adams Street, is upwind of the site. The other location, South Tacoma Way and Warner Street, is downwind of the site. Analytical results for samples collected from these locations will be used to represent, collectively, natural background and area background concentrations of chemicals of concern in blackberries.

All blackberry samples collected were composite samples that were split; one-half of the sample was analyzed unwashed and one-half was washed in deionized water



LEGEND

 ¹ BLACKBERRY SAMPLING LOCATIONS

NOTE: ALL LOCATIONS ARE APPROXIMATE.

BASE MAP REFERENCE
AMERICAN DIGITAL CARTOGRAPHY
SOUTH TACOMA, WA QUAD AND
STEILACOOM, WA QUAD

500 0 500
APPROXIMATE SCALE: 1"=500 METERS

Kennedy/Jenks Consultants

SOUTH TACOMA FIELD
TACOMA, WA

**BACKGROUND BLACKBERRY
SAMPLING LOCATIONS**

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FIGURE BB-3

prior to analysis (see Section 2.3). Analytical results for unwashed and washed composite samples were used to evaluate whether metal concentrations could be attributed to plant uptake or to atmospheric deposition, respectively.

2.2 ONSITE BLACKBERRY SAMPLING

One composite sample was collected from each of the six onsite sampling areas designated in the Final Work Plan (ICF 1990b). Of these six samples, one was collected in each of two high-perceived risk areas, one in each of the two in medium-perceived risk areas, and one in each of the two in low-perceived risk areas. Perceived-risk areas are listed below and approximate sample locations are shown in Figure BB-1.

High Risk	Medium Risk	Low Risk
Amsted Property	Former Swamp/Lakebed	Airport Area
BNR Dismantling Yard	BNR Railyard	TIP Property

Composite samples from various locations within each risk area were collected and submitted for priority pollutant metals and boron analyses. All onsite samples collected were split; one-half of the sample was analyzed unwashed and one-half was washed in deionized water prior to analysis (see rationale for these procedures in Section 2.1 above).

2.3 SAMPLE COLLECTION METHODS

Blackberry samples were collected on 16 and 17 August 1991. Composite blackberry samples were collected from reasonably accessible areas within each sampling unit from locations representative of the entire area (see Figure BB-3) and from offsite locations (see Figure BB-1). Sampling methods are detailed in the Blackberry Investigation FSAP Amendment (Kennedy/Jenks Consultants 1991).

Blackberries were hand-picked by sampling personnel wearing latex surgical gloves. Gloves were changed between sampling locations to minimize cross-contamination. Berries were carefully placed in plastic bags and then placed in coolers having an internal temperature of approximately 4°C.

Before packing and shipping the blackberry samples to the laboratory, the berries were gently mixed by rotating them in the plastic bag. A portion of the blackberry sample was placed in a 500-mL glass jar and sealed. Deionized water was added to the remaining blackberries in the plastic bag and gently agitated. The water was poured out, and the rinsing procedure was repeated twice for a total of three rinses. The blackberries were then spread out on paper towels to dry before being placed in clean sample containers for shipment to the laboratory.

Samples were prepared for shipment to the laboratory by packing the samples in a cooler with ice to maintain an internal temperature of 4°C or less. The coolers were taped closed and custody seals were attached. Coolers were sent with chain-of-custody forms to the analytical laboratory via overnight air delivery.

Fieldnotes were taken in a bound waterproof notebook by sampling team members. Entries included general observations, the number and location of samples collected during the day, field sampling team, and weather conditions.

2.4 ANALYTICAL PARAMETERS

Sample numbers, locations, and types, and analytical parameters for the blackberry investigation are summarized in Table BB-1. Quality assurance/quality control (QA/QC) samples were collected and analyzed for the same chemicals of concern as required for all blackberry samples. A discussion of the analytical results for the background, onsite, and QA/QC samples is presented in Section 4.0.

TABLE BB-1

**SAMPLE NUMBERS, TYPES, LOCATIONS, AND ANALYTICAL PARAMETERS
FOR THE BLACKBERRY INVESTIGATION AT THE SOUTH TACOMA FIELD SUPERFUND SITE**

Investigative Task	Sample Matrix	Number of Samples Collected ^(a)	Sample Type	Sample Location ^(b)	Rationale	Analytical Parameters ^(c)
Background Sampling	Blackberry	6 (washed) 6 (unwashed)	Grab Composite	Three locations within approximately 1 mile of the site and within the South Tacoma Channel outside STF property boundaries (see Figure BB-3)	Attempt to provide data on background concentrations of metals of concern in local blackberries	• Priority pollutant metals and boron
Onsite Sampling	Blackberry	6 (washed) 6 (unwashed)	Grab Composite	Selected sampling locations (see Figure BB-1)	Quantify concentrations of metals of concern in onsite blackberries	• Priority pollutant metals and boron

NOTES:

(a) Two additional samples were also collected for QA/QC purposes.

(b) Sample locations are shown in Figures BB-1 and BB-3.

(c) Analyses for priority pollutant metals include Sb, As, Be, Cd, Total Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, and Zn. Analytical methods are outlined in the EPA-CLP (EPA 1990). Blackberries were analyzed for boron using EPA Method 6010.

3.0 QUALITY ASSURANCE AND DATA VALIDATION

3.1 FIELD QA/QC PROCEDURES

During field operations, QC samples were collected to monitor both field and laboratory operations to help ensure maximum precision and accuracy throughout the project. QC samples consisted of one field duplicate and one transfer blank sample.

One field duplicate sample was collected during the investigation. The field duplicate was treated as a separate sample from the original (i.e., the field duplicate was assigned a unique sample number). This sample was not identified to the analytical laboratory as a duplicate. The duplicate was handled in the same manner as the other environmental field samples (i.e., the duplicate was split, one-half was unwashed and one-half was washed in deionized water prior to analysis).

One transfer blank was collected to monitor for entrainment of chemicals of concern into the sample from existing atmospheric conditions at a sampling location during the sample collection process. The transfer blank was prepared by filling a sample container with deionized water at a randomly selected location. The transfer blank was analyzed for the same parameters as the environmental samples. Analytical results for QC samples collected during the Blackberry Investigation are presented in Appendix A.

3.2 LABORATORY QA/QC REVIEW

Analytical methods outlined in EPA's Contract Laboratory Program (CLP) Statement of Work (EPA 1990b) were used to measure priority pollutant metals and boron in the blackberry samples. EPA's CLP methods specify QC procedures that the laboratory is expected to meet or exceed. These procedures include analysis

frequency and QC limits for laboratory method blanks, spiked samples, duplicates, and laboratory control samples. Analytical results and QC criteria were evaluated by the laboratory as part of their data reduction and documentation procedures, and in accordance with those outlined in the STF QAPjP (Kennedy/Jenks/Chilton 1991). Laboratory qualifiers were assigned to data during this review as outlined in the CLP Statement of Work (EPA 1990b). A list of laboratory-assigned data qualifiers is presented in Appendix A.

3.3 INDEPENDENT QA/QC REVIEW OF LABORATORY DATA

Data were received from the laboratory in hard-copy or magnetic format, or both. A QA review of magnetic data was performed prior to its input into the STF database. This independent review included the following activities:

- Verification of sample location numbers and laboratory accession numbers
- General review to check completeness of data packages
- Comparison of all magnetic data vs hard copy data.

Data validation qualifiers were manually entered into pre-assigned database files by one person and reviewed by another for errors. After these validation qualifiers were input and checked, the database file(s) was then appended to the master STF database and printed for a final QA review.

3.4 DATA VALIDATION

Data validation of analytical results was performed to evaluate procedural compliance to QA objectives as outlined in the STF QAPjP (Kennedy/Jenks/Chilton 1991) and to assess the laboratory's performance in meeting the QC specifications for

detection limits, accuracy, precision, and completeness as outlined in the CLP Statement of Work (EPA 1990b). Data validation was performed by EcoChem, Inc.

Data validation was based on the criteria described in the functional guidelines for evaluating inorganic analyses (EPA 1988c). Data that did not meet required criteria were flagged with validation qualifiers. A list of data validation qualifiers is presented in Appendix A.

A 100-percent data validation was completed for all blackberry sample results. EcoChem prepared a Data Validation Report to summarize findings for the Blackberry Investigation. This report is presented in Appendix A.

4.0 INVESTIGATIVE RESULTS DISCUSSION

A discussion of the analytical results for blackberry samples collected from background and onsite locations is presented in this section. This section includes an evaluation of the analytical results for four sampling components of the investigation:

- Background vs onsite samples
- Unwashed vs washed samples
- Natural background vs area background samples
- QA/QC samples.

4.1 EVALUATION OF ANALYTICAL RESULTS

A summary of analytical results for all samples is shown in Table BB-2. Complete database printouts are presented in Appendix A. Comparative discussions of these results are summarized in Sections 4.1.1 through 4.1.4.

4.1.1 Background vs Onsite Samples

A comparison of analytical results for samples collected from offsite (background) and onsite locations indicates:

- Chemicals of concern were detected more frequently in blackberry samples collected from background locations compared with those collected from onsite locations. Background samples exhibited the presence of detectable chemicals of concern more than twice as frequently as onsite samples.
- Concentrations of chemicals of concern detected in samples collected from onsite locations are generally equivalent to those detected in samples

TABLE BB-2

**ANALYTICAL RESULTS^(a,b,c,d) FOR CHEMICALS OF CONCERN DETECTED IN BLACKBERRY SAMPLES
COLLECTED ON AND IN THE VICINITY OF THE SOUTH TACOMA FIELD SUPERFUND SITE**

Sample Number	Location	Onsite/ Offsite	Unwashed/ Washed	Analyte (mg/kg)													
				Sb	As	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag	Ti	Zn	B
2051	BNR Railyard	Onsite	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	B 3.70 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	4.50 UJ 4.50 UJ	B 4.40 U 3.80
2052	BNR Dismantling Yard	Onsite	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	6.20 UJ 5.40 UJ	U 3.80 B 7.00
2053	Swamp/Lakebed	Onsite	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	B 2.50 UJ 4.20 UJ	U 3.80 U 3.80
2150 (duplicate)	Swamp/Lakebed	Onsite	un w	U 4.00 U 4.00	B 0.50 B 0.43	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 B 0.22	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	4.10 B 3.90	U 3.80 U 3.80
2054	Airport	Onsite	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	B 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	11.40 B 2.80 UJ	U 3.80 U 3.80
2055	Amsted	Onsite	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	4.70 UJ 4.70 UJ	U 3.80 U 3.80
2056	TIP	Onsite	un w	U 4.00 U 4.00	2.90 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	5.10 UJ 4.60 UJ	U 3.80 U 3.80
2061	58th & Adams Street (area background)	Offsite (upwind)	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 U 1.00	U 0.20 UJ U 0.20 UJ	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	6.30 UJ 5.90 UJ	U 3.80 U 3.80
2062	58th & Adams Street (area background)	Offsite (upwind)	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	B 1.40 B 1.10	B 3.00 B 2.90	B 0.23 U 0.20	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	B 3.00 B 3.70	B 7.40 U 3.80
2063	South Tacoma Way & Warner St. (area background)	Offsite (downwind)	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	B 2.20 B 2.50	U 0.20 U 0.20	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	4.00 5.50	U 3.80 U 3.80
2064	South Tacoma Way & Warner St. (area background)	Offsite (downwind)	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	B 1.70 U 1.00	U 0.20 U 0.20	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 U 0.20	7.20 4.30	U 3.80 U 3.80
2065	Flett Creek (natural background)	Offsite (upwind)	un w	U 4.00 U 4.00	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 B 2.02	U 0.20 B 0.35	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	U 0.20 B 0.27	5.30 4.20	B 8.30 U 3.80
2066	Flett Creek (natural background)	Offsite (upwind)	un w	U 4.00 B 6.40	U 0.40 U 0.40	U 0.20 U 0.20	U 0.40 U 0.40	U 1.00 U 1.00	U 1.00 B 1.10	U 0.20 B 0.52	U 0.10 U 0.10	U 3.00 U 3.00	U 0.60 U 0.60	U 0.80 U 0.80	B 0.86 U 0.20	B 3.20 B 3.80	U 3.80 U 3.80
2054WW	Transfer Blank ^(e)	Onsite	NA ^(f)	U 20.00	U 2.00	U 1.00	U 2.00	U 5.00	U 5.00	B 1.20	U 0.20	U 15.00	U 3.00	U 4.00	U 1.00	B 2.90 UJ	U 19.00

NOTES:

- (a) Each analyte column has three subdivisions: 1) the left margin contains the laboratory qualifier, 2) the middle value is the detected concentration, and 3) the right margin contains data validation qualifiers (see Pb and Zn).
 (b) B is the laboratory qualifier indicating that the analyte was detected at a concentration less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL).
 (c) U is the laboratory qualifier indicating that the analyte was undetected at the reported concentration.
 (d) UJ is the data validation qualifier indicating that the analyte was not present at the reported concentration; the associated value may not accurately or precisely represent the concentration necessary to detect the analyte in the sample.
 (e) Transfer blank concentrations are reported in ug/L.
 (f) NA = Not applicable.

collected from background locations. Most detected concentrations occurred between the instrument detection limit (IDL) and the contract required detection limit (CRDL). However, arsenic was detected at 2.9 mg/kg in one onsite sample, and zinc concentrations ranged from 3.00 mg/kg (background) to 11.4 mg/kg (onsite).

- Zinc and copper were detected in most background blackberry samples, but was only detected in three onsite samples.
- Thallium was detected (at concentrations below the CRDL) only in blackberry samples collected from background locations.
- Arsenic was detected in two of seven blackberry samples collected from onsite locations.
- Lead was detected more often in blackberry samples collected from background locations compared with those collected from onsite locations.

4.1.2 Unwashed vs Washed Samples

Nine samples exhibited detectable concentrations of chemicals of concern in either the unwashed or washed sample (but not both) collected from a particular location. Ten chemicals of concern were detected in unwashed samples but not in the associated washed samples. Seven chemicals of concern were detected in the washed samples but not in the associated unwashed samples.

Arsenic and zinc were detected in both the unwashed and washed samples from one onsite location. Copper, chromium, and zinc were detected in both the unwashed and washed samples from five background locations. Concentrations for washed samples were generally lower than concentrations for unwashed samples.

For example, in six of ten instances, chemicals of concern had lower concentrations in the washed samples compared with the associated unwashed samples.

However, in the remaining four instances, concentrations of chemicals of concern were higher in the washed samples compared with the unwashed samples.

Higher concentrations in the washed samples might be explained by the following conditions:

- For most samples where the concentration increased in the washed sample (compared with the concentration in the associated unwashed sample), the concentrations were detected slightly above the IDL, but below the CRDL. Concentrations reported in this range can be considered to be less precise compared with concentrations that exceed the CRDL.
- Laboratory variability could account for the reported higher concentrations in the washed samples compared with the unwashed samples.
- Water used to wash the samples may have contained low concentrations of the chemicals of concern and could have contaminated the blackberry samples. Low concentrations of lead ($1.2 \mu\text{g/L}$) were detected in the deionized water.
- Each sample contained a small number of blackberries that were collected from a large number of blackberry bushes. If washing the blackberries had little or no effect on the concentration of the chemicals of concern, it is possible (although unlikely) that the majority of blackberries containing higher concentrations of metals ended up only in the washed sample.
- Field variability could account for higher concentrations in the washed samples. For example, dust may not settle uniformly on the blackberries, and the constituency of the dust could also vary.

4.1.3 Natural Background vs Area Background Samples

As discussed in Section 2.1, blackberry samples collected from the Flett Creek area are considered to be more representative of natural background conditions (i.e., chemicals of concern detected in blackberries may be a result of plant uptake). Blackberries collected from other offsite locations are considered to be representative of area background conditions (i.e., chemicals of concern detected may be a result of both naturally occurring and human activities).

A comparison of analytical results from natural and area background locations indicates:

- Zinc was detected in five of six samples collected from background locations.
- Concentrations in samples collected from natural background locations were equivalent to those for area background locations.
- Of the nine occurrences of chemicals of concern detected in samples collected from natural background locations, five chemicals of concern were detected in the washed sample but not in the associated unwashed sample.
- Excluding zinc, all detected chemicals of concern were detected slightly above the IDL and below the CRDL.
- Samples collected upwind of the STF site were more likely to exhibit chemicals of concern compared with samples collected downwind.
- Blackberry samples collected from natural background locations were as likely to exhibit chemicals of concern as samples collected from area background locations.

4.1.4 QA/QC Samples

Evaluation of the field duplicate sample and the transfer blank indicates:

- Arsenic, lead, and zinc were detected in the duplicate sample, but not in the original sample. This difference may be a result of laboratory variability (i.e., the original and duplicate samples were not analyzed in the same sample delivery group). The difference may also be caused by difficulties in homogenizing the blackberry sample (only 1 g was used from the 500-mL sample container supplied to the laboratory).
- Lead and zinc were detected in the transfer blank. However, the zinc value was qualified as undetected during data validation because zinc was detected in the laboratory blank.

5.0 CONCLUSIONS

- Because metals are ubiquitous in the environment, the presence of metals in blackberry samples would not be unexpected.
- Zinc was detected in most samples collected from background locations and from one sample collected from an onsite location. The presence of zinc in blackberry samples is probably due to natural plant uptake (Whitney and Hamilton 1984).
- The presence of arsenic at a higher relative concentration in one sample is not conclusive evidence that arsenic is a pervasive problem in the TIP area or across the STF site.
- Low concentrations of lead and zinc in the wash water may have increased the concentration of lead detected in some samples, although not significantly.
- Many of the low detection values have been qualified due to low concentrations of chemicals of concern in the laboratory blanks and low spike recoveries. These conditions could account for the detection of chemicals of concern in the washed samples but not in the associated unwashed samples or the detection of higher concentrations in the washed sample compared with the associated unwashed sample.
- The concentration of chemicals of concern detected in both the unwashed and washed samples from a particular sampling location usually declined in the washed sample compared with the unwashed sample. These results would indicate that atmospheric deposition is a potential (but small) source for chemicals of concern detected in blackberry samples collected from background and onsite locations.

- Concentrations of chemicals of concern detected in blackberries collected from background locations were likely to occur more frequently than concentrations for blackberries collected from onsite locations. This tendency may be a result of restricted access to the STF site, suggesting that STF activities, historical and current, are unlikely to significantly influence the presence of chemicals of concern in blackberries growing on the STF site.
- Samples collected from natural background locations were as likely to exhibit chemicals of concern as samples collected from area background locations. Therefore, either the source of the chemicals of concern at both locations is naturally occurring or background locations are affected by anthropogenic sources (i.e., the Flett Creek site would be considered an area, not a natural, background location).
- Samples collected upwind of the STF site were more likely to exhibit chemicals of concern compared with samples collected downwind. It is possible that chemicals of concern occur from natural causes to a greater extent than from anthropogenic effects.
- The presence of zinc in samples collected from background locations may be a result of anthropogenic sources (e.g., atmospheric deposition from vehicular traffic).

In general, concentrations of chemicals of concern in blackberries collected from the STF site and from background locations are low, usually near detection levels. Blackberries from the STF site are probably not a significant health risk because of the low concentrations, site access restrictions, and limited availability (i.e., blackberries are present approximately 1 month each year).

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APPENDIX A

Blackberry Investigation Data Appendix

BLACKBERRY INVESTIGATION REPORT

SOUTH TACOMA FIELD SUPERFUND SITE

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

DATA APPENDIX

Prepared for

SOUTH TACOMA FIELD SITE GROUP

Prepared by

KENNEDY/JENKS CONSULTANTS
Engineers and Scientists
530 South 336th Street
Federal Way, Washington 98003
(206) 874-0555

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1.0 INTRODUCTION

This Data Appendix contains information pertinent to the South Tacoma Field (STF) Blackberry Investigation, which included an investigation of potential contamination associated with the following matrix:

- Blackberries from six sampling units on the STF site (one washed sample and one unwashed sample from each unit)
- Blackberries from background (offsite) areas (6 locations).

The Blackberry Investigation is one of several components of the STF Remedial Investigation (RI), which is being conducted in accordance with the following EPA-approved planning documents: STF Document and Data Management Plan, STF Field Sampling and Analysis Plan, STF Quality Assurance Project Plan, and STF Site Safety and Health Plan (Kennedy/Jenks/Chilton 1991a,b,c,d).

1.1 DATA APPENDIX ORGANIZATION

This Data Appendix has been organized into eight tabbed sections to allow ready access to explanatory material and analytical data printouts. The analytical data printouts are presented in Section 7.0. A description of the contents of each appendix section is provided in Sections 1.2 through 1.8.

1.2 SAMPLE CODE DESCRIPTION

A sample code was developed to enable the data reviewer to identify pertinent information regarding the sample based on this code. The sample identification used on sample forms and sample labels was a concatenation of the location number (see Section 1.2.1) plus the sample code. In addition, data are sorted and retrieved using key components of the code. The sample code is a 19-character code composed of the following five components:

- Location code (four-digit code)
- Matrix (two-letter code)
- Sample type (six-digit code)
- Depth (five-digit code, which includes a decimal point at the fourth position of this code)
- Event (two-digit code).

Each component of the STF sample code is described in Sections 1.2.1 through 1.2.5. Additional details regarding the sample code are provided in Section 2.0.

1.2.1 Location Code

A unique four-digit number was assigned to each location where a sample was collected. Geographic information (i.e., northing coordinate, easting coordinate, and elevation) was calculated or collected for each location by a licensed land surveyor (PEI/Barrett). Location codes were used to relate the geographic information database with the analytical database for the purposes of mapping chemical distributions for the STF site using a geographic information system (GIS) (see Sections 1.3 and 3.0 for additional information regarding the location code).

1.2.2 Matrix Code

A two-letter code was used to identify each matrix sampled during the STF Remedial Investigation (RI). The following codes were assigned to sample matrices:

- SS Surface soil
- SB Subsurface soil
- SD Sediment
- GF Groundwater, filtered
- GU Groundwater, unfiltered
- SF Surface water, filtered
- SU Surface water, unfiltered
- BB Blackberry
- TS TCLP extraction for soil
- WS Water extraction for soil
- CS Coarse-sieved soil (0.075-2.0 mm)
- FS Fine-sieved soil (less than 0.075 mm)
- WW Quality assurance/quality control (QA/QC) blank (water).

1.2.3 Sample Type Code

The sample type code [a.k.a. System Multipurpose Key (SMK)] is a six-digit number that identifies whether the sample is a regular environmental sample, a multiple sample, a duplicate sample, or a blank (or some combination of one or more of those sample types). The first four digits were used for differentiating among the first three sample types and the last two digits are reserved for identification of blanks. A regular environmental sample is denoted as "000000." The blanks were identified using the following numbers in the last two places of the sample type code:

- 00 Regular environmental sample (not a blank)
- 01 Field blank
- 02 Rinsate blank
- 03 Trip/transfer blank.

Additional explanatory information for the SMK is provided in Section 2.0.

1.2.4 Depth

Depth is a 5-digit number that identifies the depth in feet below the ground surface. The fourth "digit" of this five-digit code is a decimal point. Depth is not associated with blackberry samples. Surface soil samples were collected from the surface to a 6-inch depth. Surface water samples were collected as grab samples near the water surface. Sediment samples were collected from the top 2 inches of sediment at the water/sediment interface. For subsurface samples, the entire length of a split-spoon sampler will be used when sampling an interval, but the depth at the top of the core is used to reference depth. Groundwater samples will be collected from an approximate depth measured from the top of casing at elevation above sea level to the depth of the dedicated submersible pump.

1.2.5 Event Code

Some matrix investigations had multiple sampling events. Those events were differentiated using the two-digit event code. The first sampling event was assigned "00" and 1 was added to each subsequent sampling event. For example, 2nd quarter groundwater samples were assigned an event code of "01" and 3rd quarter samples were assigned "02." However, the first biweekly surface water/sediment sampling event was assigned "50" and 1 was added to each subsequent event. The first storm sampling event was assigned a "20" and 1 was added to each subsequent event. Sampling events with only one scheduled event were assigned an event code of "00" (e.g., Phase I surface soil and blackberries).

1.3 SAMPLE LOCATION DATA

The boundary of the STF site was surveyed by a licensed land surveyor (PEI/Barrett). Horizontal survey control is based on the City of Tacoma coordinates, which were converted to 1983 NAD datum and Washington State Plane Coordinate datum. Vertical datum for the site is NGVD29 (National Geodetic Vertical Datum of 1929), which is also the datum for the City of Tacoma.

A "dummy" location code was assigned to the blackberry samples because these samples were a composite of berries collected from one or more patches within a sampling unit (e.g., Amsted, Tacoma Industrial Properties). Because blackberry samples were composite samples, they did not have associated coordinate (x,y,z) data. Locations of blackberry patches from which composite samples were collected are shown in Figure BB-1 of this Blackberry Investigation Report.

Each investigation was assigned the following unique range of numbers:

Investigation	Location Number
Surface Soil <ul style="list-style-type: none">• Onsite• Background	0251-0953 0960-0971
Subsurface Soil <ul style="list-style-type: none">• Dry Wells• Pioneer Builders Supply<ul style="list-style-type: none">- Phase I- Phase II	1000-1009 1760 1100-1103
Groundwater <ul style="list-style-type: none">• Phase I	1750-1788
Surface Water/Sediment <ul style="list-style-type: none">• Phase I	2500-2543
Blackberry <ul style="list-style-type: none">• Onsite• Background	2051-2056 2061-2066

Each four-digit location code was converted into a three-digit hexadecimal equivalent to facilitate merging of the Kennedy/Jenks Consultant database into the EPA CERCLA Information System (CERCLIS) database. The location field in the CERCLIS database allows for only 15 characters. The EPA CERCLIS location numbers, as shown in the printout in Section 3.0, are situated to the left of the four-digit location code. The first 12 characters of the EPA CERCLIS location code is the unique EPA CERCLIS site number for STF, WAD980726301, and the last three are the hexadecimal equivalent of the location code (shown in bold type in Section 3.0 sample location data printout).

1.4 ANALYTICAL REQUIREMENTS

Analytical requirements for the STF RI are detailed in Section 4.0 (Tables 4-1 and 4-2). Laboratories, analyses, and analytical methods are provided in Table 4-1. The STF RI target compound list (TCL) suite of chemicals and their associated contract required detection limits (CRDLs) are presented in Table 4-2 (metals and boron).

Blackberry samples were analyzed for 13 priority pollutant metals and boron. Priority pollutant metals included antimony, arsenic, beryllium, cadmium, total chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

1.5 DATABASE INDEX

The STF database index is provided in Section 5.0. The index has been developed to organize the magnetic media of all analytical data associated with the STF RI. Basically, the index is a table of database filenames (and associated disk numbers) organized by analyte group (columns) and by investigation (rows). Analytical data were organized by matrix (e.g., groundwater, soil, blackberry), by event (e.g., 1st quarter, 2nd quarter, 1st event), and by analyte group (e.g., volatiles, pesticides/PCBs, metals). A database filename was assigned for each analyte group and each matrix, investigative task, event, or associated activity. To date, the STF database index comprises approximately 280 separate files and 48 disks. Database files for each analyte group associated with a specific investigation have been copied from the master STF database to 3.5-inch magnetic disks. Magnetic disks were assigned alphanumeric designations based on sample matrix. Two sets of magnetic disks for this investigation will be transmitted to EPA with this Data Appendix.

1.6 LABORATORY AND DATA VALIDATION QUALIFIERS

Laboratory data qualifiers and data validation qualifiers (both types of qualifiers may be assigned to analytical data) are provided in Section 6.0.

Laboratory data qualifiers for inorganic analyses are listed in Table 6-1. A laboratory analyst assigns these qualifiers to data using the criteria provided in the Contract Laboratory Program (CLP) Statement of Work (SOW) for (EPA 1990b). Laboratory qualifiers for a chemical, if assigned, are situated to the left of the concentration value in the analytical data printouts (see example format in Table 1-1).

Analytical data were subjected to a rigorous data validation review to evaluate procedural compliance to quality assurance objectives and to assess a laboratory's performance in meeting quality control specifications for detection limits, accuracy, precision, and completeness as outlined in the CLP SOW for inorganics (EPA 1990b). Data validation was performed by EcoChem, Inc. These qualifiers were

assigned by an experienced data validation reviewer using the criteria provided in the functional guidelines for evaluating inorganic analyses (EPA 1988c,e).

Data validation qualifiers for all analytical data are provided in Table 6-2. Data validation qualifiers, if assigned, are situated to the right of the concentration value in the analytical data printouts (see example format in Table 1-1).

TABLE 1-1
EXAMPLE FORMAT FOR PRESENTATION OF ANALYTICAL RESULTS

Site Location Code LOC_NO + K/J_CODE	Lab Sample No. TRA_NUM	Al			Sb			As			Ba		
		Lab Q ^(a)	Conc. ^(b)	DVQ ^(c)	Lab Q	Conc.	DVQ	Lab Q	Conc.	DVQ	Lab Q	Conc.	DV Q
(19 characters)													

(a) Lab Q = Laboratory qualifier.

(b) Conc. = Concentration (units will be shown).

(c) DVQ = Data validation qualifier.

Note: Because analytical results are so extensive and in most cases will not print onto one page, results will be printed in their entirety for the grouping of analytes that fits onto one page before the next grouping of analytes is presented. For example, as shown in this table, all results for Al, Sb, As, and Ba will be presented before introducing the next analyte grouping (e.g., Be, Cd, Ca, Cr, and so on).

1.7 ANALYTICAL RESULTS

Analytical results for the Blackberry Investigation are presented in Section 7.0 of this Data Appendix. Data are arranged in order of increasing STF location number (i.e., 4-digit number).

Blackberry and associated QA results are presented in the following order:

- Onsite blackberries
- Background blackberries (offsite)

- QA/QC duplicates
- QA/QC blanks.

If a chemical was not analyzed for, a value of "0" was placed in the concentration field. However, these zeros were not included in statistical calculations.

The values shown in the database printouts (Section 7.0) may not represent the actual number of significant figures in the concentrations as presented on the Form I sheets of the CLP deliverable packages from the laboratories. The concentration field in the database was set for a maximum of 11 significant digits (i.e., seven digits preceding the decimal point and four digits following the decimal point) to accommodate the largest concentrations anticipated during the STF RI. If the actual concentration has fewer than four significant digits, the database automatically fills in zeros in the remaining spaces of the field.

Occasionally the laboratory had to dilute or re-analyze a sample to achieve quality control limits. The diluted or re-analyzed sample is designated in the database with a "D" or an "R," respectively (printed after the Lab Number). These data are located immediately below those for the original sample. Analytical data for the diluted and re-analyzed samples were used in statistical calculations.

1.8 DATA VALIDATION REPORT

The Blackberry Investigation Data Validation Report was prepared by EcoChem, Inc. One hundred percent of the analytical data were validated for this investigation. The Blackberry Investigation Data Validation Report is presented in Section 8.0 of this Data Appendix.

2.0 SAMPLE CODE
DESCRIPTION

2.0 SAMPLE CODE DESCRIPTION

2.1 DESCRIPTION OF SYSTEM MULTIPURPOSE KEY (SMK)

The SMK is a six-digit code used to distinguish the manner in which multiple samples are obtained. Each of the first four-digit positions of the code signify a specific piece of information regarding multiple samples. Because EPA has not assigned specific pieces of information for the last two digits, Kennedy/Jenks Consultants has incorporated these digits into its code to distinguish blank samples.

The information conveyed in the first six-digit positions of the SMK is summarized below.

<u>Digit Position</u>	<u>Definition</u>
1	Identifies whether the sample is an individual sample or one of a multiple sample set. For example, the sample in question could be one of a set of samples taken from a location and not further divided, one of a set of multiple samples divided in the field, one of a set of multiple samples divided in the laboratory, or a combination of the above. The actual number placed in the first-digit position will be a value ranging from 0 to 7. The meaning attached to the first-digit position number is shown in Table 2-1.
2	Identifies which sample has been retrieved from the set of multiple samples. For example, if a sampling event from a single sample point has resulted in four undivided samples, the data values reported for the first sample would have "1" in the second-digit position of the SMK code, the data values reported for the second sample would have "2" in the second-digit position of the SMK code, etc.
3	Identifies which field replicate has been retrieved from the data set. For example, if one sample was collected at the sample point and divided into several sample containers for analysis in the field, the data values reported for the first "field replicate" would have "1" in the third-digit position of the SMK code, the second field replicate would have "2" in the third-digit position of the SMK code, etc.
4	Identifies which lab replicate has been retrieved from the data set. For example, if one sample was collected at the sample point and divided into several sample containers for analysis in the lab, the data values reported for the first "lab replicate" would have "1" in the fourth-digit position of the SMK code,

the second lab replicate would have "2" in the fourth-digit position of the SMK, etc.

5 and 6 Identifies blank samples taken during a sampling event. There are three types of blank samples that can be obtained in the field: field blank (01), rinsate blank (02), and trip blank (03).

The following table will enable the user to determine the significance of the value appearing in the first-digit position of the SMK code.

TABLE 2-1
SMK NOTATION

First-Digit Code	Multiple Sample	Field Replicate	Lab Replicate
0	No	No	No
1	No	No	Yes
2	No	Yes	No
3	Yes	No	No
4	No	Yes	Yes
5	Yes	Yes	No
6	Yes	No	Yes
7	Yes	Yes	Yes

To illustrate, if the first value of the SMK code is 3, the user would know that several separate samples were taken at the sample location. None of these samples were further divided in either the field or the lab. If the first value of the SMK code is 5, the user would know that several samples were taken at the sample location and that one or all of the samples were subsequently divided in the field (i.e., data you retrieved are from a field replicate). If the first value of the SMK code is 1, the user would know that only one sample was obtained from the sample location, but it was divided into several portions in the lab (i.e., data you retrieved are from one of the lab replicates).

The SMK code illustrated below indicates that the sample is one of a multiple sample set; this particular sample was the first in the lot; it was divided in the field;

it is the first of the field replicates; it was not divided in the lab; and it is not a blank.

511000

|||||
ABCD E

KEY

- A** 5 indicates that this sample is one of a set of multiple samples that was subsequently divided into field replicates.
- B** 1 indicates that this sample is the first replicate of the set of samples for this particular station.
- C** 1 indicates that this sample is the first field replicate.
- D** 0 indicates that the original samples were not divided in the lab.
- E** 00 indicates that this sample is not a blank. These fields are currently defined as:
- 00: Regular sample (not a blank)
01: Field Blank
02: Rinsate Blank
03: Trip Blank.

Note: Material presented in Section 2.1 has been adapted from U.S. Environmental Protection Agency. 1986. Groundwater Data Management with STORET. EPA/600/M-86/007.

TABLE 2-2

EXAMPLE OF SAMPLE CODE DESCRIPTION (19-Character Code)

Sample Code Explanation					Explanation
Location Code	Matrix	Sample Type ^(a)	Depth ^(b)	Event	
0942	SS	000000	000.0	00	Regular surface soil sample collected at location 0942
1033	SS	201000	000.0	00	Duplicate surface soil samples collected at location 1033
5750 ^(c)	SS	202000	000.0	00	
0857	SS	310000	000.0	00	Split surface soil sample with ICF collected at location 0857
1563	SB	000000	016.5	00	Regular subsurface soil samples collected at 16.5 feet below ground surface at location 1563
1642	SB	201000	023.5	00	Duplicate subsurface soil samples collected at 23.5 feet below ground surface at locations 1642
5891 ^(c)	SB	202000	023.5	00	
1816	SB	310000	047.0	00	Split subsurface soil sample with ICF at location 1816

(a) See description of SMK (Section 2.1 of this Data Appendix).

(b) The decimal point is considered a digit in the 19-character code.

(c) "Dummy" location code assigned to duplicate sample.

3.0 SAMPLE
LOCATION DATA

3.0 SAMPLE LOCATION DATA

Sample location data for the Blackberry Investigation are provided in Table BB-1 of the Blackberry Investigation Report.

A "dummy" location code was assigned to the blackberry samples because these samples were a composite of berries collected from one or more patches within a sampling unit (e.g., Amsted, Tacoma Industrial Properties). Because blackberry samples were composite samples, they did not have associated coordinate (x,y,z) data. Locations of blackberry patches from which composite samples were collected are shown in Figure BB-1 of this Blackberry Investigation Report.

4.0 ANALYTICAL REQUIREMENTS

Analytical requirements for the Blackberry Investigation are presented in the following summary tables:

- Table 4-1 Laboratories, analyses, and analytical methods for the STF Superfund site
- Table 4-2 Metals and boron and CRDLs.

TABLE 4-1

LABORATORIES, ANALYSES, AND ANALYTICAL METHODS FOR THE STF SUPERFUND SITE

Laboratory	Analysis	Method
Pacific Environmental Laboratory (San Francisco, California) and Silver Valley Laboratories (Kellogg, Idaho)	Metals Copper (water) Chromium (VI) Boron TCLP Extraction ^(a) Metals Hardness Moisture	ILM01.0 EPA Method 7211 EPA Methods 1311 (extraction) and 7197 EPA Method 6010 EPA Method 1311 (extraction) ILM01.0 SM 2340B EPA Method 160.3
Analytical Technologies, Inc. ^(b) San Diego San Diego	Volatiles Semivolatiles BNA PAH Pesticides/PCBs Cyanide TCLP Extraction ^(a) VOC PAH TOC TDS TSS Moisture	OLM01.0 OLM01.0 EPA Method 8310 SOW No. 2/88 ILM01.0 EPA Method 1311 OLM01.0 EPA Method 8310 EPA Method 9060 EPA Method 160.1 EPA Method 160.2 EPA Method 160.3
Triangle Laboratories ^(c)	Dioxin and Furans	EPA Method 8290
Golder Associates ^(c)	Permeability/hydraulic conductivity Non-permeable soil Permeable soil Particle size distribution Porosity-specific gravity In-situ density In-situ moisture Compaction Atterberg limits Moisture	EPA Method 9100 ASTM D-2434, D-5084 ASTM C-117, C-136 or ASTM D-422 ASTM D-854 ASTM D-2922 ASTM D-3017 ASTM D-1557 ASTM D-4318 ASTM D-2216
Water Management Laboratories	Fecal Coliform Streptococcus Coliform	SM 908C or 909C SM 910A or 910B

NOTES:

- (a) A water extraction method will also be performed using modified EPA Method 1311 (i.e., 1:1, by weight, soil/water ratio will be used for the water extractions). The extract will be analyzed for the same parameters as the TCLP extract. A separate sample will be sent to each laboratory for these extractions.
- (b) Except as indicated for cyanide and TOC analyses by ATI's San Diego laboratory, samples will be analyzed either by ATI's Renton, WA or San Diego, CA laboratory as specified in ATI's SOP for Work Transfer (see STF QAPjP, Appendix F, Kennedy/Jenks/Chilton 1991).
- (c) Triangle Laboratories and Golder Associates are subcontractors of ATI.

TABLE 4-2

METALS AND BORON
CONTRACT REQUIRED DETECTION LIMITS (CRDL)

Analyte	Detection Limits (a)	
	Water	Soil
	ug/L	mg/kg
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1
Cadmium	5	1
Calcium	5000	1,000
Chromium (III)	(b)	(c)
Chromium (VI)	(b)	0.2(d)
Chromium (Total)	10	2
Cobalt	50	10
Copper	1(e)	5
Iron	100	20
Lead	3	1
Magnesium	5000	1,000
Manganese	15	3
Mercury	0.2	0.1
Nickel	40	8
Potassium	5000	1,000
Selenium	5	1
Silver	10	2
Sodium	5000	1,000
Thallium	10	2
Vanadium	50	10
Zinc	20	4
Cyanide	10	5
Boron	20	4

Notes:

The CRDL for water were obtained from the EPA CLP SOW for inorganics analysis (EPA 1990b), except for the CRDL for copper and chromium (VI), which were obtained from Appendix C of the STF RI/FS Final Work Plan (ICF 1990b). The CRDL for soil were also obtained from Appendix C of the Final Work Plan.

- (a) Detection limits for samples may be considerably higher depending on the sample matrix.
- (b) Only soil samples that require the full TCL will be analyzed for chromium (VI).
- (c) Chromium (III) will be calculated from the total chromium value minus the chromium (VI) value.
- (d) Chromium (VI) will be analyzed by EPA Method 1311 (the extraction) and EPA Method 7197.
- (e) Copper for water samples will be analyzed by EPA Method 7211.

5.0 DATABASE INDEX

The STF Database Index for Blackberry Investigation is presented in Table 5-1. The filenames associated with this investigation have been highlighted for reference. Two copies of the magnetic disk for the Blackberry Investigation (i.e., Disk BB1) will be transmitted to EPA with this Data Appendix.

TABLE 5-1

STF DATABASE INDEX

Investigation	ANALYTE GROUP												
	Volatiles	TICs for Volatiles	Semi-volatiles	TICs for Semivolatiles	PAH	Pest/PCBs	Cyanide	Metals	TDS/TSS	TOC	Coliforms	Geo-technical	Field Data
Groundwater	DISK GW1	DISK GW2	DISK GW3	DISK GW4	DISK GW5	DISK GW6	DISK GW7	DISK GW8	DISK GW9	DISK GW10			DISK GW11
1st Quarter	STFGUV1 ^(a)	STFGUVT1	STFGUSV1 ^(b)	STFGUST1	STFGUP1	STFGUPT1	STFGUCN1	STFGUM1	STFGUTS1	STFGUOC1	NA	NA	STFGUF1
2nd Quarter	STFGUV2	STFGUVT2	STFGUSV2	STFGUST2	STFGUP2	STFGUPT2	STFGUCN2	STFGUM2	STFGUTS2	STFGUOC2	NA	NA	STFGUF2
3rd Quarter	STFGUV3	STFGUVT3	STFGUSV3	STFGUST3	STFGUP3	STFGUPT3	STFGUCN3	STFGUM3	STFGUTS3	STFGUOC3	NA	NA	STFGUF3
4th Quarter	STFGUV4	STFGUVT4	STFGUSV4	STFGUST4	STFGUP4	STFGUPT4	STFGUCN4	STFGUM4	STFGUTS4	STFGUOC4	NA	NA	STFGUF4
Upgradient	STFGUVU	STFGUVTU	STFGUSVU	STFGUSTU	STFGUPU	STFGUPTU	STFGUCNU	STFGUMU	STFGUTSU	STFGUOCU	NA	NA	NA
Background	STFGUVB	STFGUVTB*	STFGUSVB	STFGUSTB	STFGUPB	STFGUPTB	STFGUCNB	STFGUMB	STFGUTSB	STFGUOCB	NA	NA	NA
Duplicates ^(c)	STFGUVD	STFGUVD	STFGUSVD	STFGUSTD	STFGUPD	STFGUPTD	STFGUCND	STFGUMD	STFGUTSD	STFGUOCD	NA	NA	NA
Blanks ^(d)	STFGWWV	STFGWWVT	STFGWWSV	STFGWWST	STFGWWP	STFGWWPT	STFGWWCN	STFGWWM	STFGWWTS	STFGWWOC	NA	NA	STFGWINS
Installation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	STFGWLEV
Water Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water/Sediment	DISK SUSD1	DISK SUSD2	DISK SUSD3	DISK SUSD4	DISK SUSD5	DISK SUSD6	DISK SUSD7	DISK SUSD8		DISK SUSD9	DISK SUSD10	DISK SUSD11	DISK SUSD12
1st Event	STFSUV1	STFSUVT1	STFSUSV1	STFSUST1	STFSUP1	STFSUPT1	STFSUCN1	STFSUM1	NA	NA	STFSUFS1	NA	STFSUF1
	STFSDV1	STFSDVT1	STFSDSV1	STFSDST1	STFSDP1	STFSDPT1	STFSDCN1	STFSDM1	NA	NA	NA	NA	NA
2nd Event	STFSUV2	STFSUVT2	STFSUSV2	STFSUST2	STFSUP2	STFSUPT2	STFSUCN2	STFSUM2	NA	NA	STFSUFS2	STFSDGE2	STFSUF2
	STFSDV2	STFSDVT2	STFSDSV2	STFSDST2	STFSDP2	STFSDPT2	STFSDCN2	STFSDM2	NA	NA	NA	NA	NA
3rd Event	STFSUV3	STFSUVT3	STFSUSV3	STFSUST3	STFSUP3	STFSUPT3	STFSUCN3	STFSUM3	NA	NA	STFSUFS3	NA	STFSUF3
	STFSDV3	STFSDVT3	STFSDSV3	STFSDST3	STFSDP3	STFSDPT3	STFSDCN3	STFSDM3	NA	NA	NA	NA	NA
Phase II Sediment	NA	NA	NA	NA	STFSD2P	NA	NA	STFSD2M	NA	STFSDTOC	NA	STFSD2GE	STFSD2F
Storm Events	STFSTV	STFSTVT	STFSTSV	STFSTST	STFSTP	STFSTPT	STFSTCN	STFSTM	NA	NA	STFSTFS	NA	STFSTF
Biweekly Events	STFBWV	STFBWVT	STFBWSV	STFBWST	STFBWP	STFBWPT	STFBWCN	STFBWM	NA	NA	STFBWFS	NA	STFBWF
Background	STFSUVB	STFSUVTB	STFSUSVB	STFSUSTB	STFSUPB	STFSUPTB	STFSUCNB	STFSUMB	NA	NA	STFSUFBS	NA	NA
Duplicates ^(c)	STFSUVD	STFSUVD	STFSUSVD	STFSUSTD	STFSUPD	STFSUPTD	STFSUCND	STFSUMD	NA	NA	STFSUFSD	NA	NA
Blanks ^(d)	STFWWWV	STFWWWVT	STFWWWSV	STFWWWST	STFWWWP	STFWWWPT	STFWWWCN	STFWWWW	NA	NA	STFWWWFS	NA	NA
Blackberries ^(e)								DISK BB1					
Onsite	NA	NA	NA	NA	NA	NA	NA	STFBBM	NA	NA	NA	NA	NA
Background	NA	NA	NA	NA	NA	NA	NA	STFBBMB	NA	NA	NA	NA	NA
Duplicates ^(c)	NA	NA	NA	NA	NA	NA	NA	STFBBMD	NA	NA	NA	NA	NA
Blanks ^(d)	NA	NA	NA	NA	NA	NA	NA	STFBBWWM	NA	NA	NA	NA	NA
Phase I Soil	DISK SS1	DISK SS2	DISK SS3	DISK SS4	DISK SS5	DISK SS6	DISK SS7	DISK SS8		DISK SS9		DISK SS10	DISK SS11
Surface	STFSSV	STFSSVT	STFSSSV	STFSSST	STFSSP	STFSSPT	STFSSCN	STFSSM	NA	STFSSOC	NA	STFSSGE	STFSSF
Dry Wells	STFDWV1	STFDWVT1	STFDWSV1	STFDWST	STFDWP1	STFDWPT1	STFDWCN1	STFDWM1	NA	NA	NA	NA	STFDWF1
Pioneer Builders	STFPBV	STFPBVT	STFPBSV	STFPBST	STFPBP	STFPBPT	STFPBCN	STFPBM	NA	NA	NA	NA	STFPBF
Background	STFSSVB	STFSSVTB*	STFSSSVB	STFSSSTB	STFSSPB	STFSSPTB	STFSSCNB	STFSSMB	NA	NA	NA	NA	NA
Duplicates ^(c)	STFSSVD	STFSSVD	STFSSSVD	STFSSSTD	STFSSPD	STFSSPTD	STFSSCND	STFSSMD	NA	NA	NA	NA	NA
Blanks ^(d)	STFSWWV	STFSWWVT	STFSWWSV	STFSWWST	STFSWWP	STFSWWPT	STFSWWCN	STFSWWW	NA	NA	NA	NA	NA
Phase II Soil	DISK SB1	DISK SB2	DISK SB3	DISK SB4	DISK SB5	DISK SB6	DISK SB7	DISK SB8		DISK SB9		DISK SB10	DISK SB11
Subsurface	STFSBV	STFSBVT	STFSBSV	STFSBST	STFSBP	STFSBPT	STFSBCN	STFSBM	NA	STFSBOC	NA	STFSBGE	STFSBF
Dry Wells ^(f)	NA	NA	NA	NA	STFDWP2	NA	NA	STFDWM2	NA	NA	NA	NA	STFDWF2
Background	STFSBVB	STFSBVTB	STFSBSVB	STFSBSTB	STFSBPB	STFSBPTB	STFSBCNB	STFSBMB	NA	NA	NA	NA	NA
Duplicates ^(c)	STFSBVD	STFSBVD	STFSBSVD	STFSBSTD	STFSBPD	STFSBPTD	STFSBCND	STFSBMD	NA	NA	NA	NA	NA
Blanks ^(d)	STFBWWV	STFBWWVT	STFBWWSV	STFBWWST	STFBWWP	STFBWWPT	STFBWWCN	STFBWWW	NA	NA	NA	NA	NA
Air					DISK AIR1			DISK AIR2					
Particle Size	NA	NA	NA	NA	STFCSFSP	NA	NA	STFCSFSM	NA	NA	NA	NA	NA

(a) All database filenames have a .DBF extension.

(b) Not applicable.

(c) Includes all duplicate data collected for each investigation (e.g., database file STFSSVD contains duplicate data for Phase I surface soil, dry well, and Pioneer Builders sampling events).

(d) Includes all blank data (field, trip, rinsate) collected for each investigation.

(e) Filenames on blackberry database printouts are PRTBBM, PRTBBMB, PRTBBMD, and PRTBBWWM. These printouts were created using a program written to print only priority pollutant metals (vs full TCL metals) and boron.

(f) Analyte groups to be determined after evaluation of analytical results from Phase I dry well sampling event.

Notes: As database files are transmitted to EPA on 3.5-inch magnetic disks, the filenames will be shaded on this table.

* = No records associated with this database file.

6.0 LABORATORY AND DATA VALIDATION QUALIFIERS

Laboratory and data validation qualifiers are presented in the following tables:

- Table 6-1 Laboratory data qualifiers for inorganic analyses
- Table 6-2 Data validation qualifiers for all analytical data.

TABLE 6-1**LABORATORY DATA QUALIFIERS
FOR INORGANIC ANALYSES**

Inorganic compound qualifiers are a combination of the "Q" and "C" qualifiers:

Qualifier ("Q")	Explanation
E	The reported value is estimated because of interference.
M	Duplicate injection precision not met.
N	Spiked sample recovery not within control limits.
S	The reported value was determined by the Method of Standard Additions (MSA).
W	Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.
*	Duplicate analysis is not within control limits.
+	Correlation coefficient for the MSA is less than 0.995.

Note:

Values of "S," "W," and "+" are mutually exclusive. No combination of these qualifiers can occur in the same field for an analyte.

Concentration Qualifier ("C")	Explanation
B	Reported value is less than EPA Contract Required Detection Limit, but greater than, or equal to, the Instrument Detection Limit.
U	Analyte was analyzed for, but not detected.

Reference: EPA (1990b).

TABLE 6-2

**DATA VALIDATION QUALIFIERS
FOR ALL ANALYTICAL DATA**

Data validation qualifiers are defined in EPA's Functional Guidelines for Evaluating Inorganic Analyses (EPA 1988c,e). The following validation qualifiers will be used for all data:

Qualifier	Explanation
U	<p>The analyte was analyzed for and is not present above the level associated value. The associated numerical value indicates the approximate concentration necessary to detect the analyte in this sample.</p> <p>If a decision requires quantitation of the analyte below the associated numerical level, reanalysis or alternative analytical methods should be considered.</p>
J	<p>The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are useable for many purposes.</p> <p>The following subscripts may be appended to the "J" that indicates which of the following quality control criteria were not met:</p> <p>1 Blank Contamination: indicates possible high bias and/or false positives.</p> <p>2 Calibration range exceeded: indicates possible low bias.</p> <p>3 Holding times not met: indicates low bias for most analytes with the exception of common contaminants and chlorinated ethenes (i.e., trichloroethene, 1,1-dichloroethene, vinyl chloride).</p> <p>4 Other QC outside control limits: bias not readily determined.</p>
R	Data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified.
UJ	A combination of the "U" and the "J" qualifier. The analyte was analyzed for and was not present above the level of the associated value. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

7.0 ANALYTICAL RESULTS

Data printouts of the Blackberry Investigation analytical results, including laboratory and data validation qualifiers, are provided herein. Results are presented for onsite, offsite, duplicate, and blank blackberry samples, respectively.

ANALYTICAL RESULTS FOR BLACKBERRIES

KEY	
Database File Name	Explanation
PRTBBM.DBF	Onsite Blackberries/Metals
PRTBBMB.DBF	Background Blackberries/Metals
PRTBBMD.DBF	Duplicate Blackberries/Metals
PRTBBWWM.DBF	Blanks Blackberries/Metals

**SOUTH TACOMA FIELD SUPERFUND SITE
BLACKBERRY INVESTIGATION**

ONSITE BLACKBERRY ANALYTICAL RESULTS

SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBM.DBF 11/21/91 23:00:00

12,426 bytes

11/22/91

Page 1

STP Number	Lab Number	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
2051 BB31000000.000	012198	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	B 3.7000	U W 0.2000 UJ	U 0.1000
2051 BB32000000.000	012199	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2052 BB31000000.000	012200	U 4.0000	U W 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2052 BB32000000.000	012201	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2053 BB51100000.000	012202	U 4.0000	U W 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2053 BB52100000.000	012203	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2054 BB31000000.000	012204	U 4.0000	U 0.4000	U 0.2000	U 0.4000	B 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2054 BB32000000.000	012205	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2055 BB31000000.000	012207	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2055 BB32000000.000	012208	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2056 BB31000000.000	012209	U 4.0000	U 2.9000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000
2056 BB32000000.000	012210	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000 UJ	U 0.1000

DATA VALIDATION	
DATE RECEIVED	_____
VALIDATED BY	_____ DATE _____
KEYED BY	_____ DATE _____
CHECKED BY	<i>JRM</i> DATE <i>11/22/91</i>

Analytical data for METALS FOR BLACKBERRIES for file PRTBBM.DBF 11/21/91 23:00:00

12,426 bytes

11/22/91

Page 1

SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBM.DBF 11/21/91 23:00:00

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11/22/91

Page 2

STP Number	Lab Number		Nickel (mg/kg)		Selenium (mg/kg)		Silver (mg/kg)		Thallium (mg/kg)		Zinc (mg/kg)		Boron (mg/kg)
2051 BB310000000.000	012198	U	3.0000	U	0.6000	U	0.8000	U W	0.2000		4.5000 UJ	B	4.4000
2051 BB320000000.000	012199	U	3.0000	U	0.6000	U	0.8000	U W	0.2000		4.5000 UJ	U	3.8000
2052 BB310000000.000	012200	U	3.0000	U W	0.6000	U	0.8000	U W	0.2000		6.2000 UJ	U	3.8000
2052 BB320000000.000	012201	U	3.0000	U	0.6000	U	0.8000	U W	0.2000		5.4000 UJ	B	7.0000
2053 BB511000000.000	012202	U	3.0000	U W	0.6000	U	0.8000	U	0.2000	B	2.5000 UJ	U	3.8000
2053 BB521000000.000	012203	U	3.0000	U W	0.6000	U	0.8000	U W	0.2000		4.2000 UJ	U	3.8000
2054 BB310000000.000	012204	U	3.0000	U	0.6000	U	0.8000	U	0.2000		11.4000	U	3.8000
2054 BB320000000.000	012205	U	3.0000	U W	0.6000	U	0.8000	U W	0.2000	B	2.8000 UJ	U	3.8000
2055 BB310000000.000	012207	U	3.0000	U W	0.6000	U	0.8000	U	0.2000		4.7000 UJ	U	3.8000
2055 BB320000000.000	012208	U	3.0000	U W	0.6000	U	0.8000	U W	0.2000		4.7000 UJ	U	3.8000
2056 BB310000000.000	012209	U	3.0000	U	0.6000	U	0.8000	U	0.2000		5.1000 UJ	U	3.8000
2056 BB320000000.000	012210	U	3.0000	U	0.6000	U	0.8000	U	0.2000		4.6000 UJ	U	3.8000

Analytical data for METALS FOR BLACKBERRIES for file PRTBBM.DBF 11/21/91 23:00:00

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**SOUTH TACOMA FIELD SUPERFUND SITE
BLACKBERRY INVESTIGATION**

BACKGROUND BLACKBERRY ANALYTICAL RESULTS

SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMB.DBF 11/21/91 23:00:00

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ST# Number	Lab Number	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
2061 BB310000000.000	012211	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U 0.2000 UJ	U 0.1000
2061 BB320000000.000	012212	U 4.0000	U 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U 0.2000 UJ	U 0.1000
2062 BB310000000.000	012213	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	B 1.4000	B 3.0000	B W 0.2000	U 0.1000
2062 BB320000000.000	012214	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	B 1.1000	B 2.9000	U W 0.2000	U 0.1000
2063 BB310000000.000	012215	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	B 2.2000	U W 0.2000	U 0.1000
2063 BB320000000.000	012216	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	B 2.5000	U W 0.2000	U 0.1000
2064 BB310000000.000	012217	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	B 1.7000	U W 0.2000	U 0.1000
2064 BB320000000.000	012218	U 4.0000	U N 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U 0.2000	U 0.1000
2065 BB310000000.000	012219	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000	U 0.1000
2065 BB320000000.000	012220	U 4.0000	U N 0.4000	U 0.2000	U 0.4000	U 1.0000	B 2.0200	B 0.3500	U 0.1000
2066 BB310000000.000	012221	U 4.0000	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000	U 0.1000
2066 BB320000000.000	012222	B 6.4000 UJ	U NW 0.4000	U 0.2000	U 0.4000	U 1.0000	B 1.1000	B W 0.5200	U 0.1000

DATA VALIDATION	
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VALIDATED BY _____	DATE _____
KEYED BY _____	DATE _____
CHECKED BY <i>SPM</i>	DATE 11/22/91

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMB.DBF 11/21/91 23:00:00

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SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMB.DBF 11/21/91 23:00:00

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STP Number	Lab Number	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Boron (mg/kg)
2061 BB310000000.000	012211	U 3.0000	U 0.6000	U 0.8000	U 0.2000	6.3000 UJ	U 3.8000
2061 BB320000000.000	012212	U 3.0000	U 0.6000	U 0.8000	U 0.2000	5.9000 UJ	U 3.8000
2062 BB310000000.000	012213	U 3.0000	U 0.6000	U 0.8000	U NW 0.2000	B 3.0000	B 7.4000
2062 BB320000000.000	012214	U 3.0000	U 0.6000	U 0.8000	U NW 0.2000	B 3.7000	U 3.8000
2063 BB310000000.000	012215	U 3.0000	U W 0.6000	U 0.8000	U NW 0.2000	4.0000	U 3.8000
2063 BB320000000.000	012216	U 3.0000	U 0.6000	U 0.8000	U N 0.2000	5.5000	U 3.8000
2064 BB310000000.000	012217	U 3.0000	U 0.6000	U 0.8000	U NW 0.2000	7.2000	U 3.8000
2064 BB320000000.000	012218	U 3.0000	U 0.6000	U 0.8000	U N 0.2000	4.3000	U 3.8000
2065 BB310000000.000	012219	U 3.0000	U 0.6000	U 0.8000	U N 0.2000	5.3000	B 8.3000
2065 BB320000000.000	012220	U 3.0000	U 0.6000	U 0.8000	B N 0.2700 J4	4.2000	U 3.8000
2066 BB310000000.000	012221	U 3.0000	U 0.6000	U 0.8000	B NW 0.8600 J4	B 3.2000	U 3.8000
2066 BB320000000.000	012222	U 3.0000	U W 0.6000	U 0.8000	U NW 0.2000	B 3.8000	U 3.8000

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**SOUTH TACOMA FIELD SUPERFUND SITE
BLACKBERRY INVESTIGATION**

QA/QC DUPLICATE BLACKBERRY ANALYTICAL RESULTS

SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMD.DBF 11/21/91 23:00:00

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STP Number	Lab Number	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Total Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
2150 BB512000000.000	012223	U 4.0000	B NW 0.5000 J4	U 0.2000	U 0.4000	U 1.0000	U 1.0000	U W 0.2000	U 0.1000
2150 BB522000000.000	012224	U 4.0000	B NW 0.4300 J4	U 0.2000	U 0.4000	U 1.0000	U 1.0000	B W 0.2200	U 0.1000

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DATE RECEIVED _____	
VALIDATED BY _____	DATE _____
KEYED BY _____	DATE _____
CHECKED BY <u>SPM</u>	DATE <u>11/22/91</u>

11/22/91

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMD.DBF 11/21/91 23:00:00

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Analytical data for METALS FOR BLACKBERRIES for file PRTBBMD.DBF 11/21/91 23:00:00

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STP Number	Lab Number	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Boron (mg/kg)
2150 BB512000000.000	012223	U 3.0000	U W 0.6000	U 0.8000	U NW 0.2000	4.1000	U 3.8000
2150 BB522000000.000	012224	U 3.0000	U 0.6000	U 0.8000	U N 0.2000	3.9000	U 3.8000

11/22/91

Analytical data for METALS FOR BLACKBERRIES for file PRTBBMD.DBF 11/21/91 23:00:00

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**SOUTH TACOMA FIELD SUPERFUND SITE
BLACKBERRY INVESTIGATION**

QA/QC BLANK BLACKBERRY ANALYTICAL RESULTS

SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBWWM.DBF 11/21/91 23:00:00

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STP Number	Lab Number	Antimony (ug/L)	Arsenic (ug/L)	Beryllium (ug/L)	Cadmium (ug/L)	Total Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Mercury (ug/L)									
2054	W0000001000.000	R12206	U	20.0000	U	2.0000	U	1.0000	U	2.0000	U	5.0000	U	5.0000	B	1.2000	U	0.2000

DATA VALIDATION

DATE RECEIVED _____

VALIDATED BY _____ DATE _____

KEYED BY _____ DATE _____

CHECKED BY SKM DATE 11/22/91

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Analytical data for METALS FOR BLACKBERRIES for file PRTBBWWM.DBF 11/21/91 23:00:00

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SOUTH TACOMA FIELD

Analytical data for METALS FOR BLACKBERRIES for file PRTBBWWM.DBF 11/21/91 23:00:00

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STP Number	Lab Number	Nickel (ug/L)	Selenium (ug/L)	Silver (ug/L)	Thallium (ug/L)	Zinc (ug/L)	Boron (ug/L)
2054 W000001000.000	R12206	U 15.0000	U 3.0000	U 4.0000	U 1.0000	B 2.9000 UJ	U 19.0000

Analytical data for METALS FOR BLACKBERRIES for file PRTBBWWM.DBF 11/21/91 23:00:00

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8.0 DATA VALIDATION REPORT

The Blackberry Investigation Data Validation Report has been prepared by EcoChem, Inc. A copy of this report is provided herein.

DATA VALIDATION REPORT

DATA VALIDATION REPORT

South Tacoma Field
Blackberry Sampling

Prepared for:

Kennedy/Jenks Consultants
530 South 336th Street
Federal Way, Wa. 98003

Prepared by:

EcoChem, Inc.
911 Western Avenue
Suite 523
Seattle, WA 98104

Contract: 2304 - 11

November 8, 1991

**South Tacoma Field
Blackberry Sampling**

CONTRACT LABORATORIES:

**Priority Pollutant Metals and Boron:
Silver Valley Laboratories, Inc. (SVL)
P. O. Box 929 - One Government Gulch
Kellogg, Idaho 83837**

DATA VALIDATION

Performed by:

**A. K. Bailey
J. M. Kujawa**

**ECOCHEM, INC.
911 Western Avenue
Suite 523
Seattle, WA 98104**

INTRODUCTION

The submitted data packages have been reviewed by EcoChem, Inc. Data validation packets for inorganic analyses, which detail items reviewed, are on file at EcoChem. The quality assurance evaluations performed and the resulting data qualification recommendations are summarized in the following sections:

- Total Metals

Recommended data qualifiers are based on the EPA Contract Laboratory Program (CLP) Data Validation Functional Guidelines (U.S. EPA, 1988). These guidelines require that the data reviewer use professional judgment to designate data qualifiers, but do not replace those assigned by the laboratory. Data may be qualified even though the laboratory fulfilled all the requirements stated in the EPA Statement of Work (SOW) for a particular analysis (U.S. EPA, 1990). Unless specifically stated in the text, data qualifications are not due to laboratory error or deviations from the analysis protocols defined in the EPA SOW, but are based on EPA CLP data validation guidelines.

EcoChem, Inc.'s goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are assigned a "J", "JB" or "UJ", data can be used for site evaluation purposes, but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an "R", the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet all data quality goals as outlined in the EPA CLP Functional Guidelines and as required by the South Tacoma Field Superfund Site Quality Assurance Project Plan, March, 1991.

Holding times, sample integrity and required analyses were determined by review of the chain-of-custody sheets. Chain-of-custody records were received for all samples. A summary of the samples reviewed is provided in Table 1.

TABLE 1. Summary of Data Reviewed

Sample Number	Priority Pollutant Metals and Boron
2062BB310000000.000	X
2062BB320000000.000	X
2063BB310000000.000	X
2063BB320000000.000	X
2064BB310000000.000	X
2064BB320000000.000	X
2065BB310000000.000	X
2065BB320000000.000	X
2066BB310000000.000	X
2066BB320000000.000	X
2150BB512000000.000	X
2150BB522000000.000	X
2051BB310000000.000	X
2051BB320000000.000	X
2052BB310000000.000	X
2052BB320000000.000	X
2053BB511000000.000	X
2053BB521000000.000	X
2054BB310000000.000	X
2054BB320000000.000	X
2054WW000001000.000	X
2055BB310000000.000	X
2055BB320000000.000	X
2056BB310000000.000	X
2056BB320000000.000	X
2061BB310000000.000	X
2061BB320000000.000	X

REFERENCES

Kennedy/Jenks/Chilton. 1991. Quality Assurance Project Plan South Tacoma Field Superfund Site, Tacoma, Wa. March.

U.S. Environmental Protection Agency. 1988. Functional Guidelines for Evaluating Inorganic Analyses.

U. S. Environmental Protection Agency. 1990. Contract Laboratory Program Statements of Work for Inorganics. ILM01.0.

NARRATIVE

DATA VALIDATION REPORT TOTAL METALS ANALYSES

- I. Sample Holding Times: ACCEPTABLE/All criteria met.
- II. Calibration: ACCEPTABLE/All criteria met.
- III. Blank Analyses: ACCEPTABLE/With the following exceptions.

Qualified Data:

Analyte	Qualifier	Sample Number	Reason
Zinc	UJ at the reported value	012198, 012199, 012200, 012201, 012202, 012203, 012205, 012206, 012207, 012208, 012209, 012210, 012211, 012212	Sample value <5 times blank contamination.
Antimony	UJ at the reported value	012222	Sample value <5 times blank contamination.

Discussion

Calibration blanks (ICB and CCB) and preparation blanks (PCB) were evaluated and an action limit of five times the highest associates blank concentration was determined for each affected analyte. For analytes with positive blank values, if the sample result was less than the action limit, the analyte was considered undetected at the reported concentration and assigned a U qualifier. No data qualifiers are required for undetected sample results. For analytes with negative blank values, the raw data were reviewed, and each sample raw data result was checked to see if a possible false negative or biased sample results was reported. No samples were judged to be affected by negative bias.

Lead (1.2 µg/L) and zinc (2.9 µg/L) contamination was detected in the field rinsate blank submitted. These parts per billion concentrations indicate that no significant contamination was contributed from field procedures. Therefore, no data qualifiers are required.

Samples to be qualified, based on blank results, are summarized in the above table.

IV. ICP Interference Check Sample (ICS) Analysis: ACCEPTABLE/All criteria met.

V. Laboratory Control Sample (LCS) Analysis: ACCEPTABLE/All criteria met.

VI. Duplicate Sample Analysis: ACCEPTABLE/All criteria met.

VII. Spiked Sample Analysis: ACCEPTABLE/With the following exceptions.

Qualified Data:

Analyte	Qualifier	Sample Number	Reason
Lead	UJ	012198, 012199, 012200, 012201, 012202, 012203, 012204, 012205, 012207, 012208, 012209, 012210, 012211, 012212	Spike recovery low. Detection limit may not be as low as stated.
Thallium	J4	012220, 012221	Spike recovery high. Results may be biased high.
Arsenic	J4	012223, 012224	Spike recovery high. Results may be biased high.

Discussion

All blackberry matrix spike (MS) percent recoveries were within the control limits except for arsenic, thallium, and lead. The spike recoveries for arsenic and thallium for one data group were 125.8% and 128.7% respectively. Under 1988 Functional Guidelines, detected sample results associated with a MS percent recovery greater than 125% are to be considered approximate and assigned a J qualifier, and undetected sample results are acceptable. Positive samples for arsenic and thallium are listed in the above table.

The spike recovery for lead was low for one data group, 68.8%, indicating results may be biased low. Associated results were less than the detection limits. Therefore, the detection limit is recommended to be estimated (UJ). Recommended data qualifiers are listed above.

VIII. Furnace AA Quality Control Analysis: ACCEPTABLE/All criteria met.

IX. ICP Serial Dilution: ACCEPTABLE/All criteria met.

X. Sample Result Verification: ACCEPTABLE/With the following exceptions.

Qualified Data: None

Discussion

Results were reported on a wet weight basis on the Form 1s. However, the forms state the results are on a dry weight basis. The laboratory was requested to resubmit the Form 1s stating on the new forms the results are on a wet weight basis.

The raw data were reviewed and 10% of the sample results were checked for transcription and calculation errors. No errors were found.

XI. Field Replicate Analysis: ACCEPTABLE/With the following exceptions.

Qualified Data: None

Discussion

Two field duplicates were submitted. For one set of duplicates, zinc, arsenic and lead were detected in one sample. While for the other sample, zinc was qualified as undetected due to blank contamination, and no other results are above the detection limit.

For the other set of duplicates, zinc and arsenic were detected in one sample. While for the other sample, zinc was qualified as undetected due to blank contamination, and no other results are above the detection limit.

Differences between the duplicate results may have been caused by the duplicates being analyzed within different data groups rather than field variability. No results are recommended to be qualified based solely on the field duplicates.

XII. Quarterly Submissions: ACCEPTABLE/All criteria met.

XIII. Overall Assessment of Data:

No major problems were noted in review of the data set. Blank contamination with zinc and antimony, MS high recovery for arsenic and thallium, and low spike results for lead were noted. The laboratory was requested to resubmit Form 1s stating the results are on a wet weight basis.

APPROXIMATE LOCATION OF BLACKBERRY PATCHES. 11/20/91. FIGURE BB-1